

## SHORT COMMUNICATION

**Reinstatement and lectotypification of *Calandrinia tepperiana*  
(Montiaceae)**

William Vincent Fitzgerald made numerous plant collections when he made two expeditions to the Kimberley region, on the Crossland Expedition in 1905 and a separate one in 1906. His collections from these trips included many new species that are described in Fitzgerald (1918). One of the species in that publication, *Calandrinia tepperiana* W.Fitzg., is described as an erect, glabrous, annual with terete, fleshy basal leaves, having up to several scapes ending in short racemes, and flowers with six to eight, lanceolate petals. Furthermore, flowers had numerous stamens, four stigmas, and four-valved, ovoid capsules with numerous smooth and shining seeds. In his description, Fitzgerald cites two collections he made from the May and Lennard Rivers ‘in grassy sandy spots’. These locations are within the current IBRA bioregion of Dampierland, typically characterised by plains with red, sandy soils.

*Calandrinia tepperiana* remained as a current name for Western Australia’s flora until West (1992) synonymised it under *C. quadrivalvis* F.Muell. in *Flora of the Kimberley Region*. These species are certainly similar in many respects including habit, size of inflorescences, and particularly seed shape and size. However, *C. tepperiana* differs in having terete basal leaves, rather than the flat to very compressed leaves seen on *C. quadrivalvis*, and whereas the latter is often papillate on the basal leaves, stems and sepals, *C. tepperiana* is never papillate. *Calandrinia tepperiana* nearly always has eight to ten petals (rarely 7 or 11) while *C. quadrivalvis* most commonly has six petals (rarely 7). It also differs in having seeds that are quite smooth and glossy, but occasionally are also lightly colliculate, while *C. quadrivalvis* seeds are somewhat duller, usually with a strongly colliculate surface pattern. It is true that the seeds of the Kimberley collections of *C. tepperiana* can often be similar in size to *C. quadrivalvis* (i.e. 0.4 mm long), but they can also be significantly larger (i.e. 0.5 mm long) and particularly larger in the Pilbara where they can be up to 0.6 mm long.

Apart from the obvious morphological differences listed above, the two species are separated geographically by the King Leopold Ranges. This range marks the boundary between the IBRA bioregion of Dampierland to the west and the bioregions of Northern Kimberley and Central Kimberley to the east. *Calandrinia tepperiana* occurs to the west and south-west of this range on the red, sandy pindan soils while *C. quadrivalvis* occurs to the north-east and east on different geology and soils. The distribution of *C. tepperiana* further southwards into the Great Sandy Desert bioregion is on similar sand dune country to the pindan, but in the Pilbara bioregion it is usually restricted to unconsolidated sandy soils on dry creek- or river-beds and adjacent floodplains.

We suspect that Fitzgerald, after crossing the King Leopold Ranges eastwards, saw specimens of *C. quadrivalvis* with six petals, and believing these to be *C. tepperiana*, included this minimum number (i.e. 6–8 petals) within his species concept. It is also possible that he came to this conclusion after seeing aberrant or stunted plants with six petals. In summary, it is the terete basal leaves with no papillae, the higher petal number and the different distribution that clearly separate *C. tepperiana* from *C. quadrivalvis*.

## Taxonomy

***Calandrinia tepperiana*** W.Fitzg., *J. Proc. Roy. Soc. Western Australia* 3: 141–142 (1918).

*Type citation*: ‘May and Lennard Rivers (W.V.F.).’ *Type specimens*: May River, near Poulton’s yards [Kimberley region, Western Australia], May 1905, *W.V. Fitzgerald* 431 (*lecto*, here designated: PERTH, image seen); 6 miles N.E. of Mount Eliza [near the Lennard River, Kimberley region, Western Australia], May 1905, *W.V. Fitzgerald* 739 (NSW, image seen).

Semi-erect to erect *annual* (possibly sometimes perennial) *herbs*, 40–270 mm tall, 35–300 mm wide, glabrous, the root system comprising a long, weak to relatively strong taproot with numerous finer roots, occasionally with a few intermediate-sized lateral roots. *Basal leaves* up to 120 mm long and 5 mm wide, fleshy, cylindrical, terete to sub-terete in T.S., forming a dense tuft. *Stems* usually short, up to c. 50 mm long, radiating from base, merging into erect scapes, the junction not always clear. *Stem leaves* rare, fleshy, narrowly linear to narrowly obovate, up to 20 mm long and 1.5 mm wide, usually terete, sometimes compressed. *Scapes* roughly up to 135 mm long, with two or more evenly scattered residual bracts, occasionally once- or twice-branched. *Inflorescence axis* up to 165 mm long, bare except for 3 to several  $\pm$  scarious bracts, mostly opposite particularly on the upper axis, 3–9-flowered, generally forming a loose cyme. *Inflorescence axis bracts* appressed to  $\pm$  spreading, narrowly triangular, occasionally broader, up to 4 mm long and 3 mm wide, apex acuminate. *Pedicels* up to 25 mm long, erect, to 55 mm long in fruit and moderately to strongly reflexed. *Flowers* 8–20 mm diam. *Sepals* moderately thick, ovate to broadly ovate, up to 5 mm long and 6.5 mm wide, free to base, mucronate, veins and reticulation not always prominent. *Petals* 8–10 (rarely 7 or 11), light to mid-pink, sometimes darker pink or white, elliptic to obovate, up to 9.5 mm long and 4.5 mm wide, free to base, occasionally mucronate. *Stamens* generally  $>25$ ,  $>35$  on larger flowers; filaments free, roughly to 4 mm long, attached to the top of basal ring beneath ovary; anthers elliptic to oblong in outline, roughly to 1 mm long and 0.4 mm wide, versatile, extrorse, dehiscent longitudinally, often pink-purple before anthesis. *Ovary* ovoid, roughly 1–2.5 mm diam., brown; stigmas 4, narrowly triangular to linear at maturity, to 3.6 mm long, free to base, with a dense covering of moderately long stigma trichomes. *Capsule* ovoid to broadly ovoid, 3.5–6 mm long, 2.8–3.5 mm wide, the apex obtuse and usually longer than the sepals; valves 4, at first splitting at the summit then to the base with age. *Seeds* numerous per capsule, tan to mid- to dark brown, occasionally almost black, shiny, globular to sub-reniform, to 0.6 mm long, 0.45 mm wide, 0.3 mm thick, surface pattern usually smooth, sometimes weakly colliculate and only noticeable at higher magnification.

*Selected specimens examined*. WESTERN AUSTRALIA: 10 km E of South Hedland, 24 June 1981, *P. Armstrong s.n.* (PERTH); Ngarrin Creek, Warrawagine Road, NE of Marble Bar, 24 June 2006, *A.R. Bean* 25156 (PERTH); bed of Yanarrie River at Homestead Pool, Millawitty Pool, Nyang Station, 4 May 2004, *G. Byrne* 934 (PERTH); Taylors Lagoon, Broome, 25 July 2008, *G. Byrne* 3497 (PERTH); drill site named Missing, northern Great Sandy Desert, 30 Sep. 2001, *C.P. Campbell* 3924 (PERTH); Bulka Swamp, Bohemia Downs Station, S Kimberley, 3 July 2001, *K. Coate* 633 (PERTH); c. 3 km S of Skull Springs Road, on 5 Mile Creek, E of Nullagine, 28 Aug. 2004, *R. Davis* 10722 (PERTH); saline flat just to the N of the Derby-Gibb River Road, c. 10 km out of Derby, 8 May 1988, *E.M. Goble-Garratt* 519 (PERTH); Great Sandy Desert, W of the Lamil Hills, Telfer area, 4 July 2002, *R.P. Hart* 7985 (PERTH); Sunday Island, Buccaneer Archipelago, 9 June 1982, *A.J.M. Hopkins* BA 0002 (PERTH); 4.8 km NW of Beagle Bay Aboriginal Community, Dampier Peninsula, W Kimberley, 21 June 1984, *K.F. Kennedally* 9126 (PERTH); Bea Bea middle creek, 22 km N from Mulga Downs turnoff along Great Northern Highway, Pilbara region, 4 Aug. 2015, *F. Obbens* 05/15 (PERTH); Yule River, 21.3 km E along North West Coastal Highway from junction with Great Northern Highway,

5 Aug. 2015, *F. Obbens* 09/15 (PERTH); along Marble Bar Road c. 20.7 km S from the Warralong turnoff and next to Yandicoogina Creek, 26 May 2004, *F. Obbens & B. Bromilow* FO 11/04 (PERTH); c. 6 km E along Newman rail access track from the Great Northern Highway-Wodgina mine access road intersection. Site is at the track crossing of the Turner River and area is c. 90 km directly S of Port Hedland, 29 May 2004, *F. Obbens & B. Bromilow* FO 21/04 (PERTH); West Kimberley, Lennard Hills, area of shale and granite outcrops near the Gibb River Road, c. 12 km W of Inglis Gap, 5 June 1988, *M. Sands* 5156 (PERTH); 1.1 km N towards the Petrified Forest campsites from junction of Barred Creek Road, S of the Prices Point Road, 7 June 2006, *L.S.J. Sweedman* 6793 (PERTH); site number 88, 10.9 km ESE of Mount Sabine, Millstream-Chichester National Park, Fortescue Botanical District, 16 Apr. 1997, *M.E. Trudgen* MET 15210 (PERTH); Pelican Pool, Nullagine River, Meentheena Conservation Reserve, 12.5 km SW of Meentheena Station Homestead, 11.4 km SSW of King Rock Hole, 20.7 km NW of Baroona Hill, 23 May 2001, *S. van Leeuwen* 4780 (PERTH); by bridge over River De Grey, North West Coastal Highway [Great Northern Highway], 26 June 1988, *P.G. Wilson* 13024 b (PERTH).

*Phenology.* The main flowering and fruiting period occurs from April to September and reflects the large geographic distance between northern populations and those populations much further south, and also somewhat seasonal variations within these regions. Two collections from the Kimberley region were taken outside this period (i.e. in January and February), but still appear to be *C. tepperiana*.

*Distribution and habitat.* *Calandrinia tepperiana* is widespread in the bioregions stated above. While habitat has been described above at a landscape level, it is considerably more variable between sites at the local scale, particularly in the Kimberley and adjacent areas. For example, many collections in the Kimberley are recorded as being from typical habitat of red to brown sandy soils in dune swales, flats or floodplains, while a number of others were recorded from grey clayey sand or on stony ground or red, sandy laterite, and even one in a saline situation near a soak under *Pandanus* sp. and behind a mangrove area. The vegetation communities recorded for the Kimberley also varied from grasslands to low-tree savanna to shrublands or lake-edge herbfields. Some of the associated species included *Acacia colei*, *Grevillea striata*, *Triodia pungens*, *Lysiphyllum cunninghamii*, *Eucalyptus* sp. and *Corymbia* sp.

For the Pilbara, *C. tepperiana* consistently occurs on the dry beds of water courses or adjacent banks or on previously flooded areas. The soils recorded in the Pilbara range from light red or orange-brown sands to brown sandy loams, often described as gritty or gravelly, and sometimes silty. Predominantly, the vegetation communities were described as riverine or mixed medium shrublands with a wide range of associated species, including *Eucalyptus camaldulensis*, *Acacia ampliceps*, *A. coriacea* subsp. *pendens*, *Melaleuca lasiandra*, *M. linophylla*, *Cyperus vaginatus*, *Eragrostis cumingii*, *Tephrosia rosea* var. *clementii*, *Pluchea tetrandra*, *Crotalaria cunninghamii*, *Chrysopogon fallax*, *Stemodia viscosa* and *Goodenia lamprosperma*; grass weed species also regularly occur at these sites.

*Conservation status.* *Calandrinia tepperiana* occurs over a very large area and is not considered under threat. There are 54 collections at PERTH.

*Typification.* A lectotype has been designated here to fix the application of the name *C. tepperiana*. The chosen specimen is the better of the two syntypes; however, both collections are quite poor and do not adequately display some of the key characters that define the species. Barcodes have not been provided for the type specimens because both have been on loan to CANB for an extended period and have therefore not been databased at their respective institutions.

*Affinities and notes.* A recent molecular phylogeny of Australian *Calandrinia* Kunth (Hancock *et al.* 2018), has shown that *C. tepperiana* and *C. quadrivalvis* are clearly separate taxa; the phylogenetic tree placing them in the same clade (i.e. sect. *Basales* von Poellnitz), but with numerous intervening species. In this phylogeny, *C. tepperiana* is sister to *C. pleiopetala* F.Muell. with 100% bootstrap support. *Calandrinia pleiopetala* is an eight-petalled species with smaller, strongly colliculate seeds that occurs in more inland areas than *C. tepperiana*.

Species of *Calandrinia* within the distribution of *C. tepperiana* (a 4-valved species) and with a similar number of petals to it include *C. pentavalvis* Obbens (a 5-valved species) and *C. strophiolata* (F.Muell.) Ewart, B.Rees & B.Wood (a 6-valved species). These three species are all erect plants, but differ significantly in their seed morphology. *Calandrinia uniflora* F.Muell. (a 4-valved species) with eight to 12 petals is clearly distinct from *C. tepperiana* in having a single-flowered inflorescence at the end of each scape, and the distributions of these two species barely overlap.

It is clear that the remaining collections of *C. quadrivalvis* from the central, northern and eastern Kimberley region contain other undescribed segregates alongside true *C. quadrivalvis*. The authors are currently studying this group and a publication on this topic will be forthcoming.

### Acknowledgements

We thank Russell Barrett for checking the *Calandrinia tepperiana* and *C. quadrivalvis* type collections at CANB (on loan), and providing images for us. We are grateful to the Western Australian Herbarium, Department of Biodiversity, Conservation and Attractions, for allowing access to specimens for this project.

### References

- Fitzgerald, W. (1918). The Botany of the Kimberleys, North-West Australia. *Journal and Proceedings of The Royal Society of Western Australia* 3: 102–224.
- Hancock, L.P., Obbens, F., Moore, A.J., Thiele, K., de Vos, J.M., West, J., Holtum, J.A.M. & Edwards, E. (2018). Phylogeny, evolution, and biogeographic history of *Calandrinia* (Montiaceae). *American Journal of Botany* (in press).
- West, J. (1992). *Calandrinia*. In: Wheeler, J.R. (ed.) *Flora of the Kimberley region*. pp. 134–135. (Department of Conservation and Land Management: Perth.)

### Frank Obbens<sup>1</sup> and Matthew D. Barrett<sup>2</sup>

<sup>1</sup>Western Australian Herbarium, Biodiversity and Conservation Science,  
Department of Biodiversity, Conservation and Attractions,  
Locked Bag 104, Bentley Delivery Centre, Western Australia 6983

<sup>2</sup>Kings Park Science, Department of Biodiversity, Conservation and Attractions,  
1 Kattidj Close, Kings Park, Western Australia 6005

<sup>1</sup>Corresponding author, email: frank.obbens@aapt.net.au